

Thoughts on LN2 Supply for Cold Box

David Montanari

LBNF/DUNE Interface Meeting

31 October 2018

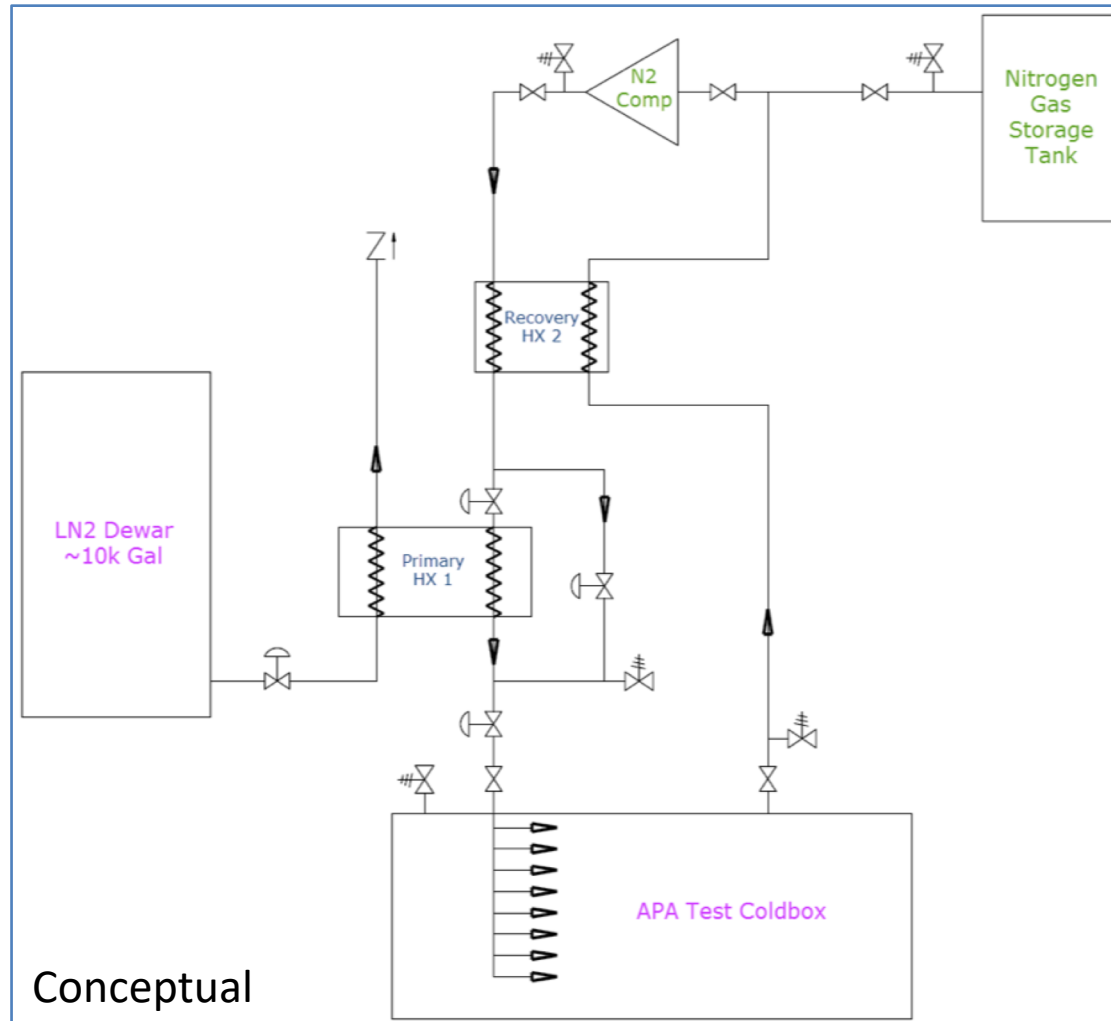
Cold Box Support – 1/2

- Nitrogen plant not available in time for the cold boxes:
 - Nitrogen System can be available, but GN2 piping in the shaft cannot be installed on time (currently 2026 vs required 2024).
 - How much LN2 is needed?
 - Estimated 15 m³ per cold box test (similar to what was used in ProtoDUNE).
 - But could be done in a semi-closed loop (more later).
- Possible Alternatives:
 - **Nitrogen generator** underground?
 - Capital cost.
 - Infrastructures needed: location, power, ventilation.
 - **Transport of dewars** underground?
 - How much can be transported down?
 - Via skip → 1 x 3 m³ (2.4 ton LN2) dewar each trip (10 min one way).
 - Via cage → 2 x 3 m³ (4.8 ton LN2) dewars each trip (10 min one way).
 - Cost of LN2 dewars + LN2 supply.

Cold Box Support – 2/2

- Can we use the planned **LN2 dewars** underground for storage (200 m³)?
 - Yes, if we move up the installation.
 - Currently available (commissioned) in Dec-2024. Could be delivered as early as Nov-2022.
- Can we use the **receiving facilities** on the surface to receive/store LN2 (50 m³)?
 - Yes, if we move up the installation.
 - Currently available (commissioned) in Sep-2025. Could be delivered as early as Jul-2022.
- To minimize LN2 consumption, this could be a **semi-closed** system:
 - Cold GN2 from an LN2 dewar.
 - Booster to circulate the GN2 through multiple heat exchangers.
 - GN2 storage to handle variations.
- Some work already done by DUNE for the cold box in ITF in Rapid City.

Cold Box Support – Possible semi-closed system from Technical Division for ITF on surface



Internal Cryogenics

- Schedule for the installation of the internal cryogenics pipes:
 - Before we position the wooden floor (at least partially).
 - In parallel to the last phase of the cold cryostat construction and the initial part of the detector installation.
 - In parallel to the detector assembly (vertical pipes).